Ann. Geophys. Discuss.,
https://doi.org/10.5194/angeo-2020-61-AC1, 2021

Annales Geophysicae Discussions
Open Access

Interactive comment on "Dynamic Spectra of Small-Mass Meteors" *by* Emma R. Mirizio et al.

Emma R. Mirizio et al.

emmamirizio@gmail.com

Received and published: 18 February 2021

The authors would like to thank the reviewer for their comments that will greatly improve the manuscript.

In response to technical questions, the authors will add explanations in the manuscript for each of the questions raised.

In terms of meteor composition's relationship to luminous efficiency, by understanding the ablation process as well as the initial proportions of the meteoroids' composition, fewer assumptions would be made in mass estimation. Particularly, the luminous efficiency can vary based on meteor composition due to bright spectral lines from a particular element (Borovicka, 1994). This would change the generally accepted values of luminous efficiency for each case rather than the wide variety of values currently used.

Radar head-echoes were used to find differential ablation in (Janches, 2009) by modeling the change in signal at different points in time. Meteor composition and differential ablation have been determined from meteor head-echoes for microgram sized meteors in the sporadic background by modeling and observing the change in radar signal over time as various elements were expected to ablate.

We will clarify the meaning of "common" and add a reference: "Commonly observed bright spectral lines in sporadic meteors correspond to elements such as Mg, Fe, Ni, and Na as well as smaller abundances of Ca (Harvey, 1973)." Added additional Borovicka references.

A statement of goals will be added: "The goal of this data collection and analysis is to find the composition and search for differential ablation for a sample of meteors using the observed spectra, as well as estimate the mass, velocity, and brightness of each meteor using optical data. In addition, this acted as a proof-of-concept study to push the limits of our imaging technology for observing the smallest meteors for which spectra could be resolved."

"Faint" will be clarified in relation to the other meteors in the sample rather than the objective quality of the meteors, and the description of the spectrum obtained from the camera pointing at zenith was clarified. Zeroth order spectrum was defined and added to Figure 1.

We discuss a separate sample of meteors from (Michell 2019). We will expand and clarify on the calibration methods using stars and lab methods in the following way. The stellar calibration resulted in a good fit, and adding additional dimmer stars to the calculation did not improve the fit or values for determining the lower bound of mass. Due to the speed at which meteors travel over the detector, it is possible that the magnitudes are underestimated when determined from the more static stars (Rendtel, 1993).

In the results and conclusion sections, we will add a figure of the image of the spectra and greatly explain the calculations made. Fixed the typo of 6 frames to 3 frames, and clarified that the figures will include a few frames of the image added together for better SNR. This sample was not found to be associated with any meteor shower, which resulted in defining the sample as consisting of sporadic meteors. For future work, adding radar measurements or triangulation, as the referee mentioned, would greatly improve the analysis. This would allow for estimates rather than lower limits on parameters such as velocity and mass. The additional figure should clarify the conclusions.

Interactive comment on Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2020-61, 2020.

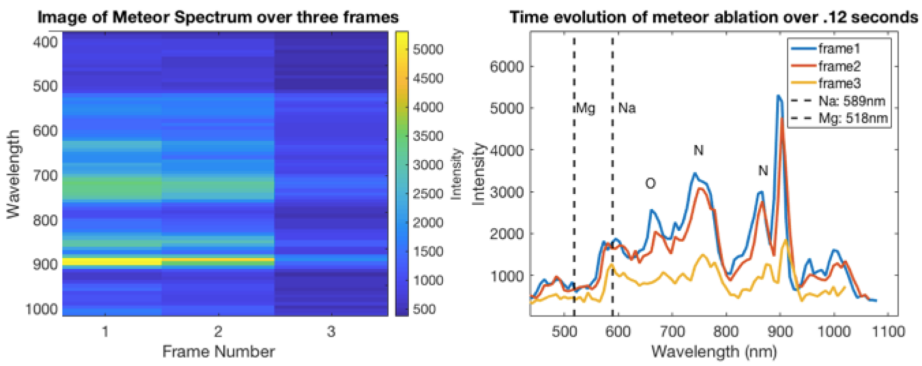

Fig. 1. Image of the spectrum of the same meteor as in Figures 4 and 5 visualized in with the intensity of spectral lines as brightness deceasing over time (left) and as line plots (right).

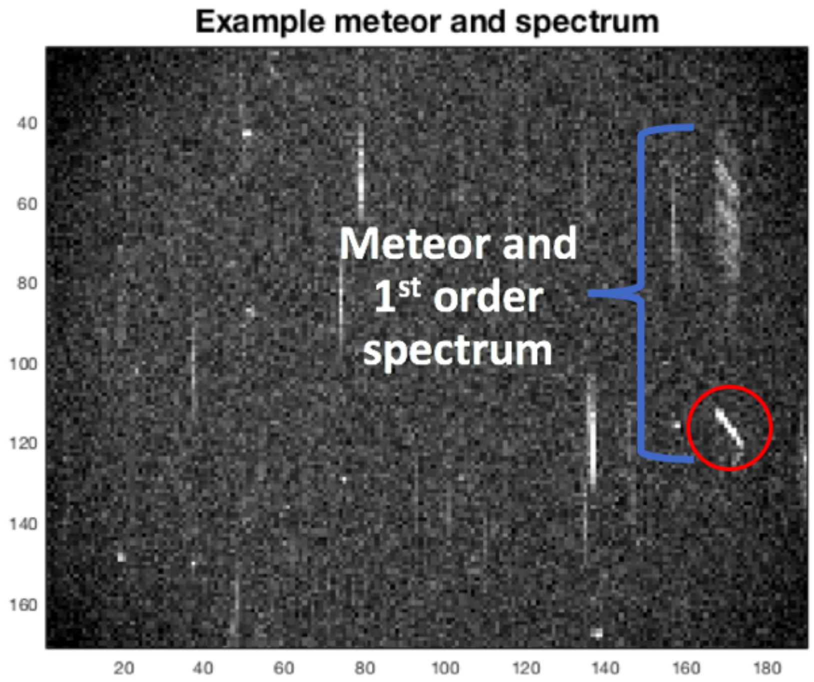

Fig. 2. An example raw image of a meteor and its spectra (left) that is uncalibrated and unflattened with the zeroth order image of the meteor circled in red.